

Five new Indian species of the genus *Dasyhelea* Kieffer (Diptera, Ceratopogonidae) with a key to the adult males

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Abstract

Five new species of biting midges, *Dasyhelea* (*Dasyhelea*) *incisura* sp. nov., *D. (D.) quasifulcillata* sp. nov., *D. (D.) trigona* sp. nov., *D. (Sebessia) falxa* sp. nov. and *D. (S.) folia* sp. nov. are described and illustrated based on adult males. The new species are compared and contrasted to their congeners; important morphological characters are displayed. All specimens were collected from the Deltaic Proper of Gangetic West Bengal, India. An illustrated key to the adult males of the subgenera *Dasyhelea* s.str. and *Sebessia* from India is presented. Short accounts on ecological notes of the midges are also provided.

Key Words

Adult, *Dasyhelea*, Ecological notes, India, New species, *Sebessia*, Taxonomy

Introduction

Dasyhelea Kieffer, 1911a is a large and complex genus of Ceratopogonidae having diverse morphology and biology. This genus has a cosmopolitan distribution (Waugh and Wirth 1976). The immature stages of many species dwell in a broad range of habitats, e.g. algae, mosses or liverworts and plants which are present on water margins (Dominiak 2012), sap oozing from trees, rotting plants or mushrooms (Waugh and Wirth 1976; Graves and Graves 1985) and in faeces (Vattier 1964). However, according to Zilahi-Sebess (1931) adults are short living and are usually found in or near breeding sites: on shrubs, herbs and on flowers (Waugh and Wirth 1976). Lee et al. (1989) stated some tropical species are pollinators of cocoa trees, *Theobroma cacao* L. and rubber trees, *Hevea brasiliensis* (Willd. Ex Adr. Juss.) Muell. Arg. Wirth and Waugh (1976) discovered five new of *Dasyhelea* species from the Neotropical region associated to cocoa cultivation.

To date more than 640 species described from all over the world including around 141 species from the

Oriental region. Though there are 27 Indian species described previously, only 13 species should be considered. Because, Brahma et al. (2020) proposed to consider 13 species of Kieffer (1910, 1911b, 1913) as *nomina dubia*, and Borkent and Dominiak (2020) also proposed *Dasyhelea subornaticornis* Sinha and Das Gupta, 2010 as *nomen dubium*. Recently, Szadziwski and Gwizdalska-Kentzer (2020) and Han et al. (2020) described one species each from the Palearctic (UAE) and Oriental regions (Sichuan, China) respectively. However, more detailed taxonomic and biological studies of this genus are needed.

This paper aims to describe and illustrate five new species of the genus: *Dasyhelea* (*Dasyhelea*) *incisura* sp. nov., *D. (D.) quasifulcillata* sp. nov., *D. (D.) trigona* sp. nov., *D. (Sebessia) falxa* sp. nov. and *D. (S.) folia* sp. nov. A key to the adults having pictorial representations of certain characters of new species of the subgenera *Dasyhelea* s. str. and *Sebessia* Remm, 1979 from India and short accounts on ecological notes of each new species are provided.

Materials and methods

Adults were caught using a light trap with an 8W LED light operated at the collection sites (Fig. 1) in the Deltaic proper of Gangetic West Bengal, India. The adults were preserved in 80% alcohol. The location of the collection sites are depicted using Google Map (Fig. 1). The insects were mounted on glass slides following Wirth and Marston (1968). Terminology of adults follows Brown et al. (2009). Thoracic chaetotaxy follows Sæther (1980). Measurements of detailed structures are expressed in micrometres (μm) while total body length, flagellum length, length and width of wing are in millimetres (mm); ranges and mean values (in parentheses) are provided when three or more specimens (n) were examined. The illustrations were prepared using a compound microscope (Wild Leitz GMBH, Portugal) in combination with a mounted *camera lucida*. The photographs were taken with a trin-

ocular compound microscope (Wild Leitz GMBH). The new species are differentiated from other allied species after comparison of diagnostic morphological characters from the relevant literature. Distribution of the allied species are furnished in parentheses. Few species of the *patagonica* group (Díaz et al. 2010) were also considered for comparison with the new species belonging to the subgenus *Sebessia* Remm, 1979 as Dominiak (2012) suggested that species belonging to that group should be included in the subgenus *Sebessia*.

Type specimens are currently in the BUENTD (Burdwan University Entomology Division), Burdwan (India) and will be submitted to the NZCI (National Zoological Collections of India), Kolkata (India).

Abbreviations of morphological terms used in the text and/or figures: **Adult**, **AR**—Antennal ratio, **PR**—Palpal ratio, **WL**—Wing length, **WW**—Wing width, **CR**—Costal ratio, **TR**—Tarsal ratio.

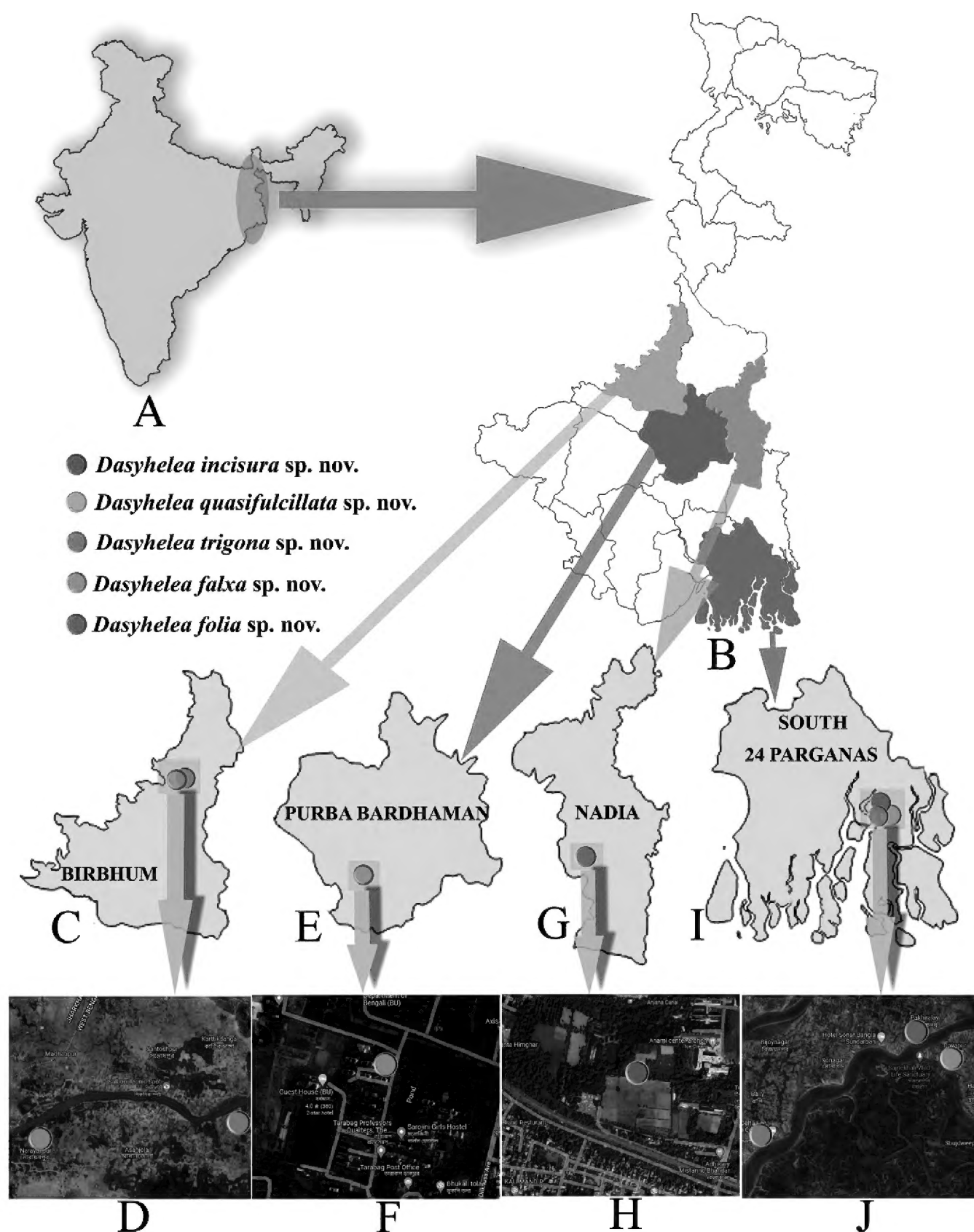


Figure 1. A–J Collection sites. A Map of India; B Map of West Bengal showing the districts where collections were made; C, E, G, I Species specific collection site positions within the four districts; D, F, H, J Satellite imageries of the collection localities (Google Map: Imagery 2022 Maxar Technologies, CNES / Airbus, Imagery 2022 TerraMetrics, Map data 2022).

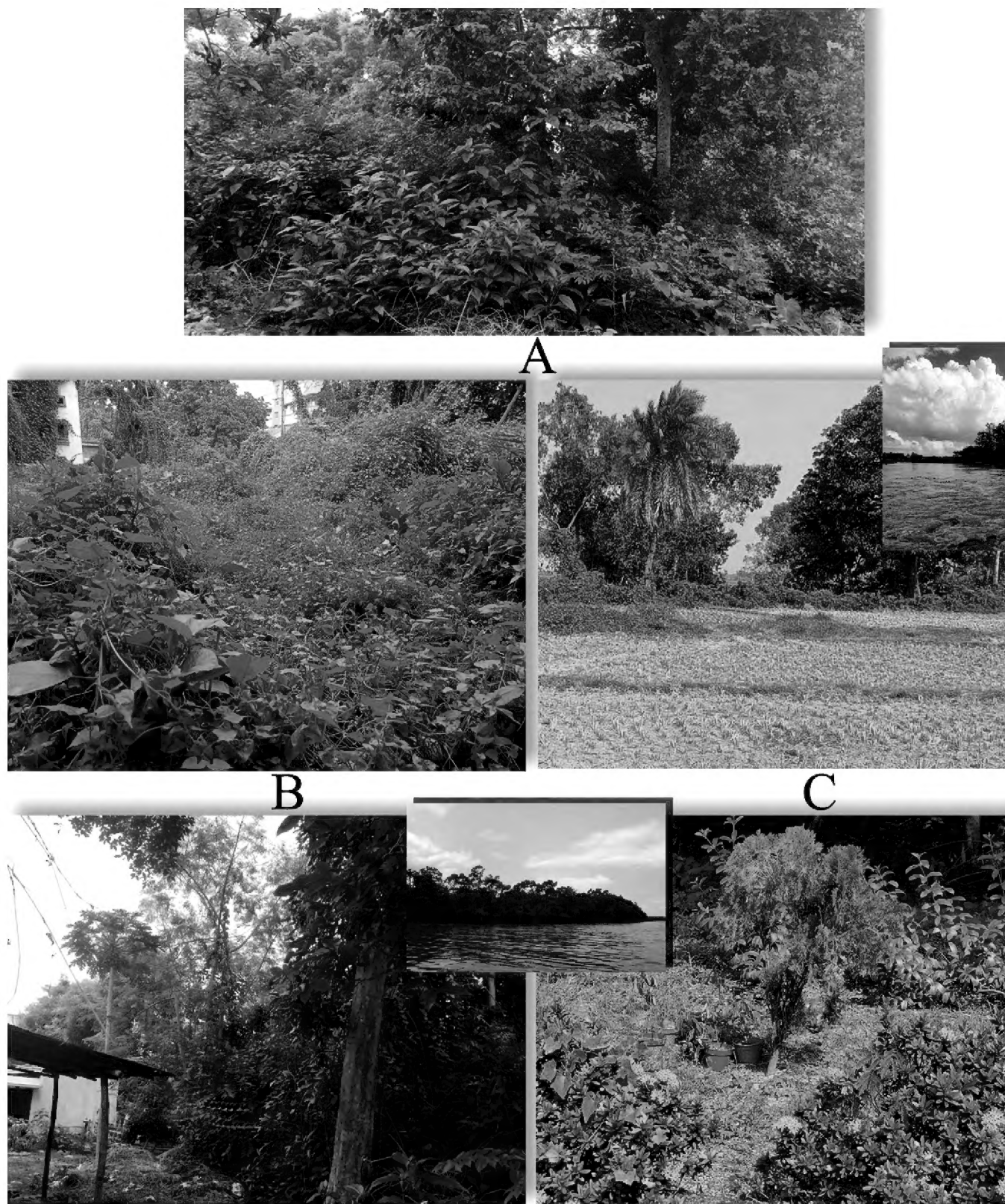


Figure 2. A–E Photographs of collection sites where light traps were operated. **A** Collection site of *Dasyhelea* (*Dasyhelea*) *incisura* sp. nov.; **B** Collection site of *Dasyhelea* (*D.*) *quasifulcillata* sp. nov.; **C** Collection site of *Dasyhelea* (*D.*) *trigona* sp. nov. (adjacent fresh water river shown as different image at upper right corner); **D** Collection site of *Dasyhelea* (*Sebessia*) *falxa* sp. nov.; **E**. Collection site of *Dasyhelea* (*S.*) *folia* sp. nov. (adjacent brackish water river is same for both D and E, shown as different image at upper middle).

Results

Taxonomy

Genus *Dasyhelea* Kieffer, 1911a

Subgenus *Dasyhelea* s. str.

Dasyhelea incisura sp. nov.

<https://zoobank.org/AF553256-4835-4060-A668-AC92F1EE2548>

Type material. *Holotype* ♂, India, West Bengal, Nadia, Krishnanagar [23°24'04.1"N, 88°28'48.9"E], 21.II.2017, Coll. S. Brahma.

Diagnosis. The only species in the subgenus *Dasyhelea* having an urn shaped clypeus with basal region having pointed shape; flat gonostylus tip bearing subapical notch or constriction at inner side and series of long setae at ventrolaterad of gonostylus.

Description. Male (n = 1) (Figs 3A–K, 8A). Total body length 2.08 mm.

Head. Dark brown in colour. Eyes separated by half of diameter of ommatidium. Frontal sclerite (Fig. 3A) heart shaped basally with apical long projection, with broad base, 69 µm long, 55 µm wide, evenly sclerotised except apical projection less sclerotised. Flagellum (Fig. 3B) brown, 0.7 mm long; flagellomere XIII with a distinct apical nipple; flagellomeres III–XIII (only visible) with sensilla basiconica; length ratio of flagellomeres (I–XIII): 27: 14: 15: 15: 15: 15: 16: 16: 16: 32: 28: 25: 35; AR 0.88. Clypeus (Fig. 3C) urn shaped, with 4 pairs of setae. Palpus (Fig. 3D) pale brown; length ratio of palp segments (I–V): 7: 13: 16: 12: 11; PR 4.00; palp segment III with 4 capitate sensilla at apex.

Thorax (Fig. 3E). Chocolate brown in colour with two longitudinal pale stripes on both sides dorsally. Acrostichals 7–8 pairs, irregularly biserial; dorsocentrals 4–5 pairs, irregularly biserial and 5–7, uniserial; scutellum with 7 setae.

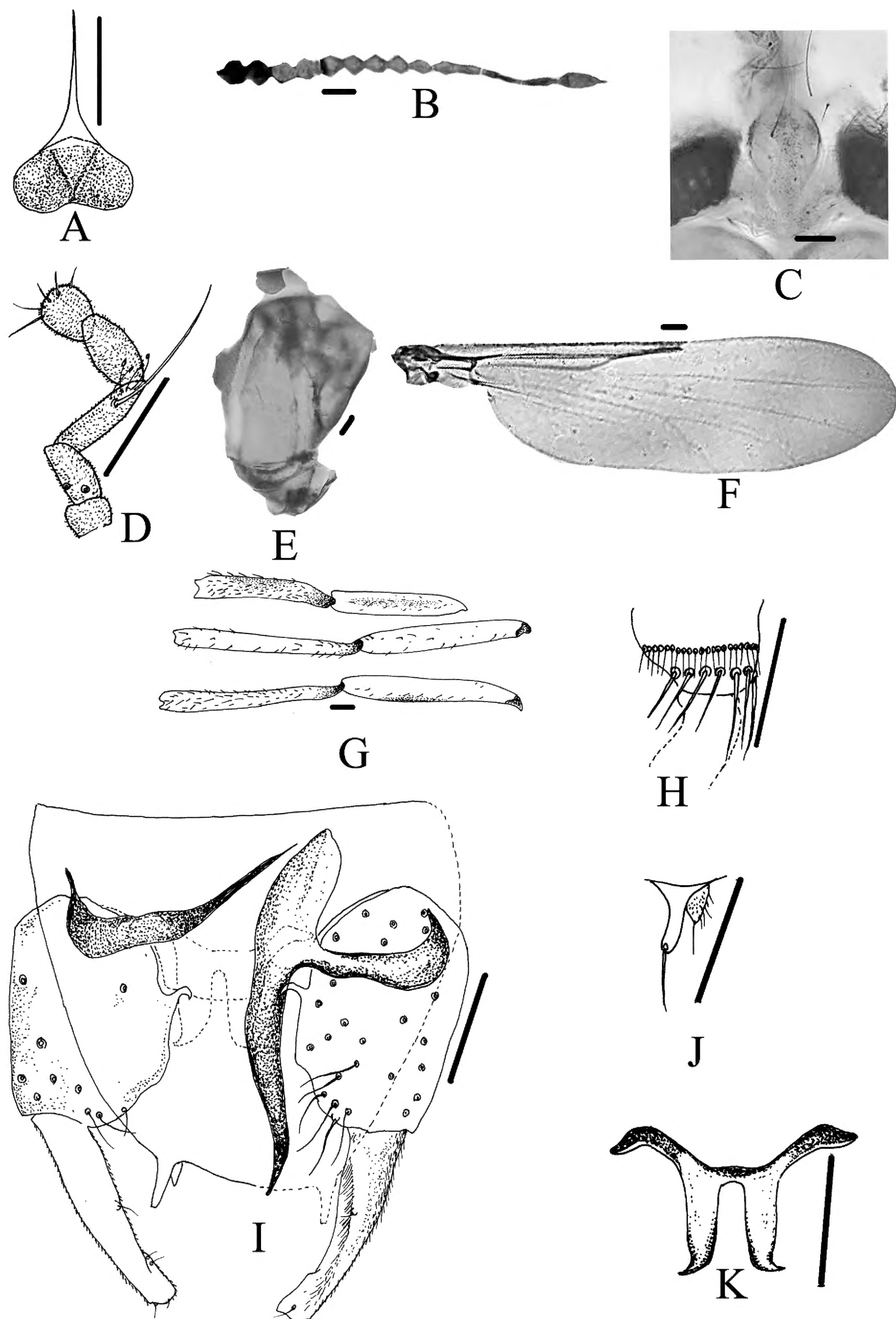


Figure 3. A–K Adult male of *Dasyhelea* (*Dasyhelea*) *incisura* sp. nov. **A** Frontal sclerite; **B** Flagellum; **C** Clypeus; **D** Palpus; **E** Thorax; **F** Wing; **G** Femora and tibiae (right to left) of fore, mid and hind legs; **H** Hind tibial comb; **I** Genitalia (left dorsal and right ventral view); **J** Apicolateral process; **K** Aedeagus. Scale bars: 0.05 mm.

Wing (Fig. 3F). Wing with sparse macrotrichia. WL 1.1 mm, WW 0.36 mm, CR 0.48. Cubital fork starting before costal extremity.

Legs (Fig. 3G). Pale brown in colour. Hind femur infuscated at mid region. Hind tibial comb (Fig. 3H) with 7 spines. TR_I 2.55, TR_{II} 2.8 and TR_{III} 2.75.

Abdomen. Brown in colour.

Genitalia (Figs 3I, 8A). Tergite 9 broad, 154 μ m long, 188.5 μ m wide. Apicolateral processes (Fig. 3J) tubular, 23 μ m long, with one prominent apical seta; cercus broad, 11.5 μ m long, setose with one distinct seta at apex. Sternite 9 2.68 \times wider than length, with convex posteromedian margin. Gonocoxite broad, stout, 85 μ m long, greatest width 69 μ m, having 4–5 setae dorsally and 20–23 setae ventrally. Gonostylus stout, 92 μ m long, 18.5 μ m wide basally, 13.5 μ m wide apically with inwardly directed one prominent seta dorsally and ventrally each at about mid length; a distinct notch or constriction present on inner side at about three fourth length from base bearing two prominent setae, subapex bearing one seta ventrally and apex bearing two minute setae, mid ventrad of gonostylus with series of long setae. Left basal arm of parameres (Fig. 3I) 94.5 μ m long, right one 57.5 μ m long, both moderately sclerotised, recurved at anterior, right one strongly connected with 142.5 μ m long, gradually tapered posteromedian projection of parameres, while left one having no attachment with parameres. Aedeagus (Fig. 3K) 48 μ m long, 83 μ m wide; basal arms 25 μ m long, stout, highly sclerotised at tip, directed laterad enclosing 50.5 μ m wide basal arch; posterolateral arms 39 μ m long, inflated a little with apical recurved tip, directed laterad; ventromedian projection lacking.

Female adult. Unknown.

Pupa and Larva. Unknown.

Etymology. The name “*incisura*” derived from Latinised version of *notch*, referring to presence of prominent notch on inner side at three fourth length from the base of gonostylus in male genitalia.

Remarks. *Dasyhelea (Dasyhelea) incisura* sp. nov. resembles *D. digna* Borkent, 1997 (USA) in similar posterior margin of sternite 9, very similar parameres and overall same appearance of aedeagus, but tip of the gonostylus and tip of the posterolateral arm of aedeagus are contrasting. Both parameres and aedeagus of *D. correntina* Ronderos, Díaz & Spinelli, 2004 (Argentina) are roughly alike with those of *D. incisura*, but the tip of the gonostylus, the tip of the posterolateral arm and the basal arm of the aedeagus are markedly different. The parameres of *D. yunga* Díaz, Spinelli & Ronderos, 2018 (Argentina) has close similarity with that of *D. incisura*, but the shape of the aedeagus is dissimilar. The combination of characters provided in the diagnosis validates *D. (D.) incisura* as a new member of this subgenus.

Distribution. The specimen was collected from the Deltaic Proper of Gangetic West Bengal from an altitude of 14 meters – new species from India.

Ecological notes. Adult *Dasyhelea (D.) incisura* sp. nov. were collected from shrub vegetation (Fig. 2A) when

the air temperature was 25–26 °C and the relative humidity was 83%; no aquatic ecosystem was in proximity of the collection site.

***Dasyhelea (Dasyhelea) quasifulcillata* sp. nov.**

<https://zoobank.org/54053E58-FB6F-4BE4-A02D-161D8880D2D0>

Type material. *Holotype* ♂, India, West Bengal, Purba Bardhaman, Burdwan [23°15'03.8"N, 87°50'45.1"E], 11.IV.2017, Coll. S. Brahma. *Paratypes*: 2♂♂, data same as before, except 20.IV.2018; 2♂♂, India, West Bengal, Birbhum, Narayanpur [24°14'40.6"N, 87°41'30.7"E], 8.II.2017, Coll. S. Chatterjee.

Diagnosis. The only species in the subgenus *Dasyhelea* diagnosed by a vertical unsclerotised region in frontal sclerite; gonocoxite with two long apical setae ventrally; posteromedian projection of parameres broad, blade like; posterolateral arm of aedeagus with flap like extensions inwardly directed.

Description. **Male adult** (n = 5) (Figs 4A–K, 8B). Total body length 1.8–1.9 (1.85) mm.

Head. Dark brown in colour. Eyes separated by one fourth of diameter of an ommatidium. Frontal sclerite (Fig. 4A) 57–58 (57.5) μ m long and 54–56 (55) μ m wide, hyperbolic, evenly sclerotised, except mid vertical line, with a minute apical projection. Antennal flagellum (Fig. 4B) pale brown, 0.50–0.6 (0.55) mm long; XIII with a distinct apical projection; length ratio of flagellomeres (I–XIII): 18 (18): 11–13 (12): 11–13 (12): 11–13 (12): 11 (11): 12 (12): 12 (12): 12 (12): 12 (12): 24–25 (24.5): 23 (23): 18–19 (18.5): 35–36 (35.5); AR 1.00 (1.00); flagellomeres II–XIII with sensilla basiconica. Clypeus (Fig. 4C) with 4 pairs of setae. Palpus (Fig. 4D) pale; length ratio of palp segments (I–V): 9 (9): 11–12 (11.5): 20 (20): 12 (12): 14–15 (14.5); PR 2.2 (2.2); palp segment III with 2 capitate sensilla at lower half region.

Thorax (Fig. 4E). Brown in colour without any prominent infuscation. Acrostichals with 9–10 pairs, irregularly biserial; dorsocentrals 8–9 pairs, irregularly biserial; prealars 7, uniserial; scutellum with 5 setae.

Wing (Fig. 4F). Wing margin with short, prominent macrotrichia; r_5 with macrotrichia at anterior region. WL 0.90 (0.90) mm, WW 0.30–0.32 (0.31) mm, CR 0.45 (0.45). Cubital fork present before costal extremity.

Legs (Fig. 4G). Pale in colour, mid region of fore, mid and hind femora, and fore and mid tibiae prominently infuscated, hind tibia with diffused infuscation. Hind tibial comb (Fig. 4H) with 8 spines. TR_I 2.83–3.16 (3.01), TR_{II} 2.85–3.45 (3.14) and TR_{III} 2.61–3.00 (2.73).

Abdomen. Brown in colour.

Genitalia (Figs 4I, 8B). Tergite 9 broad apically, inverted dome shaped, 120–122 (121) μ m long and 224–225 (224.5) μ m wide anteriorly, 50–51 (50.5) μ m wide posteriorly. Apicolateral processes (Fig. 4J) 11–12 (11.5) μ m long with one prominent apical seta, cercus setose with median sized setae. Sternite 9 4.81 \times wider than length, with a middle concave excavation. Gonocoxite

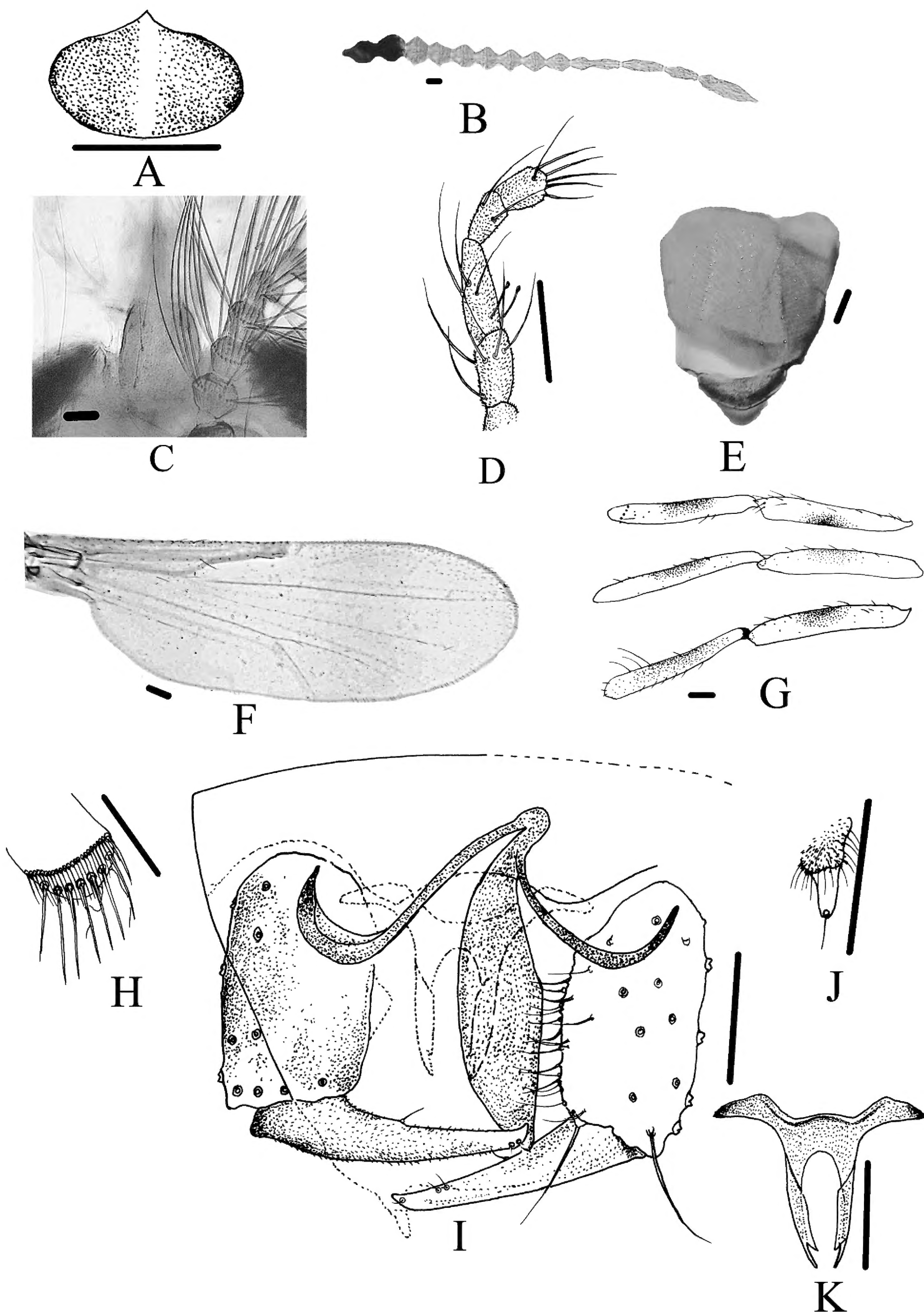


Figure 4. A–K Adult male of *Dasyhelea* (*Dasyhelea*) *quasifulcillata* sp. nov. **A** Frontal sclerite; **B** Flagellum; **C** Clypeus; **D** Palpus; **E** Thorax; **F** Wing; **G** Femora and tibiae (right to left) of fore, mid and hind legs; **H** Hind tibial comb; **I** Genitalia (left dorsal and right ventral view); **J** Apicolateral process; **K** Aedeagus. Scale bars: 0.05 mm.

stout, elongated, 89–90 (89.5) μm long, greatest width 55 (55) μm . Gonostylus long, gradually tapering, 82–83.5 (83) μm in length, 18–19 (18.5) μm wide basally and 6 (6) μm wide apically; one distinct seta at mid length, distal one fifth region containing two prominent stout setae, subapex bearing 2 setae dorsally and one seta ventrally. Parameres thin, highly sclerotised (Fig. 4I) with left basal arm 78–79 (78.5) μm long, joined moderately with posteromedian projection; right basal arm 53–54 (53.5) μm long; posteromedian projection 107–108 (107.5) μm long, 25–26 (25.5) μm wide medially, bladelike, moderately sclerotised, terminating in a point beyond gonocoxite-gonostylus junction. Aedeagus (Fig. 4K) broad, 69 (69) μm long, 82–83 (82.5) μm wide, basal arm 32–33 (32.5) μm long, highly sclerotised, directed laterad; basal arch 44–45 (44.5) μm long; posterolateral arm 46 (46) μm long, stout with flaplike inward projection.

Female adult. Unknown.

Pupa and Larva. Unknown.

Etymology. The name “*quasifulcillata*” refers to its close similarity with allied species, *D. (Dasyhelea) fulcillata* Yu, 2005.

Remarks. The new species resembles *Dasyhelea (Dasyhelea) fulcillata* Yu in Yu et al. 2005 (China) in the shape of the both basal arms of parameres, posteromedian projection of parameres and basal arm of aedeagus, but it differs in the margin of sternite 9, the apex of gonostylus, the absence of prominent seta at about mid length of gonostylus, basal arch and apex of posterolateral arm of the aedeagus. *Dasyhelea (D.) neofusca* Yu in Yu et al. 2005 (China) also has similar shaped parameres and margin of sternite 9, but the structure of the apicolateral process, the gonostylus and the aedeagus are contrasting. *Dasyhelea bilineata* Goetghebuer, 1920 (Belgium, Russia, Norway, Finland, Estonia, Great Britain, Ireland, Hungary, Germany, Poland, Czech Republic, Slovakia, Switzerland, Austria, France, Croatia, Italy, Romania, Ukraine, Spain, Turkey, Gibraltar, Bulgaria, and Algeria) bears little similarity with *D. (D.) quasifulcillata* sp. nov. in overall structure of the gonocoxite and aedeagus, while the basal arm of the aedeagus and the shape of the parameres differ from each other. The present species shares resemblances with *D. (D.) flavifrons* (Guérin-Ménéville, 1833) (France, Belgium, Estonia, Germany, Poland, Great Britain, Czech Republic, Switzerland, Austria, Croatia, Spain, Bulgaria, Greece, Russia, Ukraine, and USA) in parameres, but apical portion of gonostylus, basal arms, and basal arch of the aedeagus markedly differ. *Dasyhelea (D.) malleola* Remm, 1962 (Estonia, Spain, Andorra, Poland, Germany, Czech Republic, Ukraine, and Algeria) has identical basal arms of the parameres, but the posteromedian projection of the parameres, apex of the gonostylus and posterolateral arm of the aedeagus are opposing with those of *D. quasifulcillata*. However, the combination of characters provided in the diagnosis validates *D. (D.) quasifulcillata* as a new member of this subgenus.

Distribution. The specimens were collected from the Deltaic Proper of Gangetic West Bengal at an altitude 30–42 meters above sea level – new species from India.

Ecological notes. *Dasyhelea (D.) quasifulcillata* sp. nov. adults were captured around shrub vegetation and paddy field area adjoining a freshwater river (Fig. 2B) when the air temperature was 27–35 °C and relative humidity was 70–75%.

***Dasyhelea (Dasyhelea) trigona* sp. nov.**

<https://zoobank.org/F1CB60B1-616A-4803-AF13-4BDFCF50B374>

Type material. *Holotype* ♂, India, West Bengal, Birbhum, Boidhora [24°14'59.4"N, 87°44'20.2"E], 25.XII.2016, Coll. S. Chatterjee. *Paratype*: 1♂, India, West Bengal, South 24 Parganas, Bali Island [22°05'19.6"N, 88°45'25.7"E], 15.V.2017, Coll. S. Brahma.

Diagnosis. The only species in the subgenus *Dasyhelea* having tubercles on the frontal sclerite, femora with infuscation beyond the mid region and an aedeagus with ventral triangular basal arms.

Description. **Male adult** (n = 2) (Figs 5A–K, 8C). Total body length 2–2.1 mm.

Head. Dark brown in colour. Eyes separated by half of diameter of ommatidium. Frontal sclerite (Fig. 5A) 57.5 μm long, 55 μm wide, with oval base, small dome shaped apical portion ending in a threadlike projection and base containing sclerotised tubercles. Antennal flagellum (Fig. 5B) brown, 0.9 mm long; flagellomere XIII with a distinct apical projection; length ratio of flagellomeres (I–XIII): 17: 14: 11.5–12: 12: 15–15.5: 14–14.5: 14: 15: 15: 29–29.5: 23.5–24: 20: 38.5–39; AR 1.00; flagellomeres III–XIII (visible) with sensilla basiconica. Clypeus (Fig. 5C) with 4 pairs of setae. Palpus (Fig. 5D) pale brown; length ratio of palp segments (I–V): 6: 10–10.5: 13: 11–11.5: 14; PR 2.16; palp segment III with 6 capitate sensilla at proximal half.

Thorax (Fig. 5E). Brown in colour without any prominent infuscation. Acrostichals 11–12 pairs, biserial; dorsocentrals 10–11 pairs, biserial and 7, uniserial; 13 prealars; scutellum with 6 setae.

Wing (Fig. 5F). Wing margin with short, prominent macrotrichia; anterior margin of r_5 with microtrichia. WL 0.95–1.00 mm, WW 0.35 mm, CR 0.5. Cubital fork lying well before costal extremity.

Legs (Fig. 5G). Pale brown in colour. Femora infuscated at mid region, mid tibia with diffused infuscation, proximads of tibiae dark brown. Hind tibial comb (Fig. 5H) with 7 spines, third one from inner longest. TR_I 3.14–3.18, TR_{II} 3.14 and TR_{III} 2.94.

Abdomen. Brown in colour.

Genitalia (Figs 5I, 8C). Tergite 9 broad apically, 100.5–101 μm long and 172–173 μm wide. Apicolateral processes (Fig. 5J) short with basal notch, 11–12 μm long, with one prominent apical seta, cercus with three setae. Sternite 9 2× wider than length, with convex margin. Gonocoxite stout, elongated, 78 μm long, greatest width 46–57.5 μm , having 3–4 setae dorsally. Gonostylus stout, long, gradually tapering, 92–94 μm in length, 23–30 μm wide basally, 9 μm wide subapically, 7–8 μm

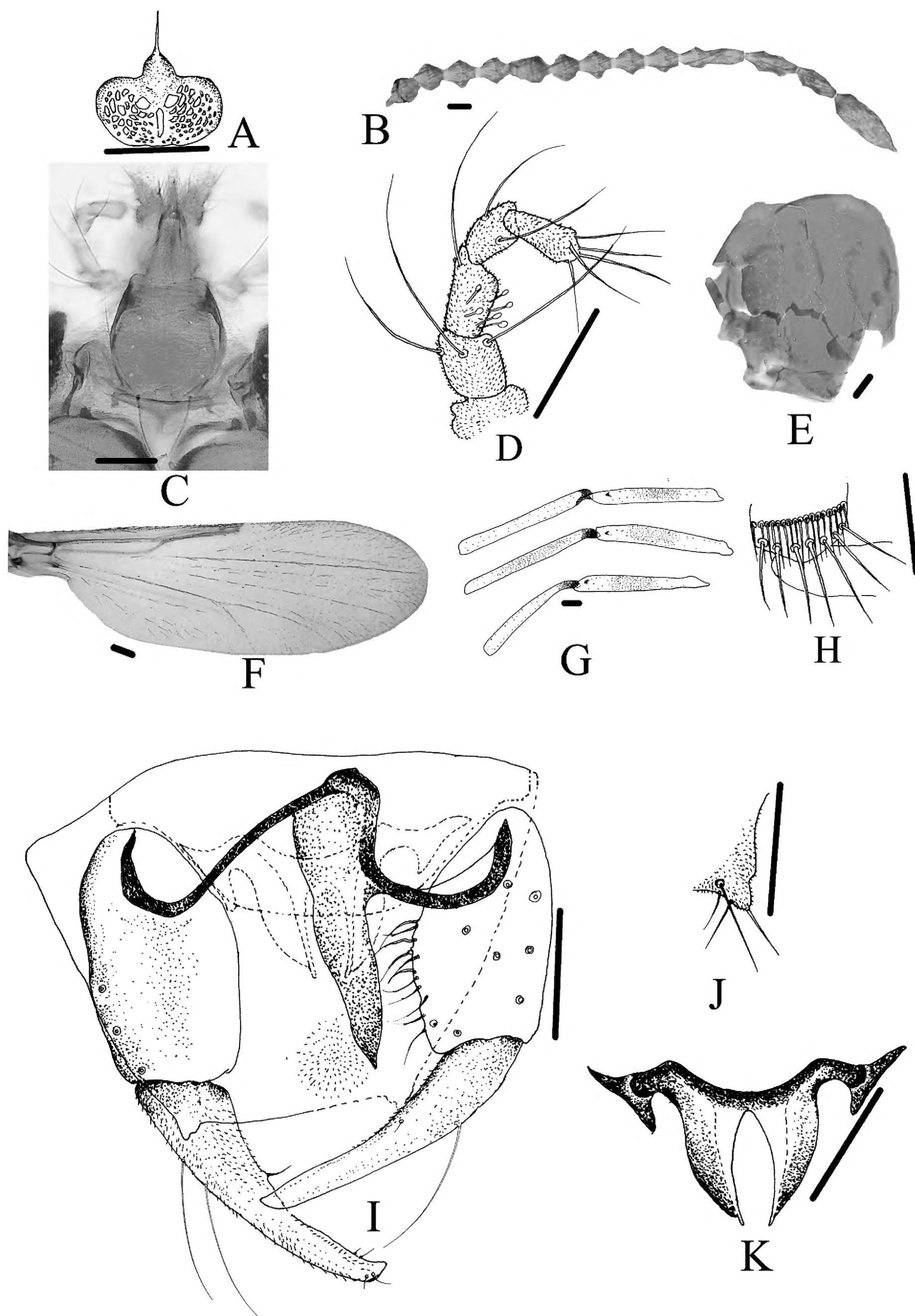


Figure 5. A–K Adult male of *Dasyhelea* (*Dasyhelea*) *trigona* sp. nov. **A** Frontal sclerite; **B** Flagellum; **C** Clypeus; **D** Palpus; **E** Thorax; **F** Wing; **G** Femora and tibiae (right to left) of fore, mid and hind legs; **H** Hind tibial comb; **I** Genitalia (left dorsal and right ventral view); **J** Apicolateral process; **K** Aedeagus. Scale bars: 0.05 mm.

wide apically; 2 long setae present at about proximal one fourth and one third length dorsally and 1 long seta at about proximal one third, all directed outwardly; one prominent, seta from about half distance from base, directed inward, 2 prominent setae subapically and 2 at apex. Left basal arm of parameres (Fig. 5I) 103.5 μm long, and right basal arm 90–92 μm long, both thin, highly sclerotised, joined broadly with 92 μm long, 16–18.5 μm wide, moderately sclerotised, and pointed tipped posteromedian projection of parameres terminating at level of gonocoxite-gonostylus junction. Aedeagus (Fig. 5K) broad, 50.5–57.5 μm long, 94–99 μm wide, basal arm 18.5–19 μm long, highly sclerotised, directed slightly posterolaterad, ending in triangular projection ventrally, basal arch 32–44 μm long, posterolateral arm 34.5–39 μm long, stout, ending in point; bifurcated, tubular ventromedian projection.

Female adult. Unknown.

Pupa and Larva. Unknown.

Etymology. The name “*trigona*” derived from Latinised version of *triangle*, referring to triangular ventral region of the basal arm of the aedeagus of male genitalia.

Remarks. The new species *Dasyhelea* (*D.*) *trigona* bears similarities with *D. (D.) fulcillata* Yu in Yu et al. 2005 (China) in the shape of the gonocoxite and basal arms of the parameres, but differs in the apicolateral process, absence of setae at the basal half of gonostylus, and the overall structure of the parameres and the aedeagus. It is also close to *Dasyhelea* (*D.*) *abdita* Yu in Yu et al. 2005 (China) in the structures of parameres and aedeagus, but the basal arm of aedeagus, the apicolateral process and the apex of gonostylus are different. The present species owes resemblances with *D. (D.) actita* Yu in Yu et al. 2005 (Taiwan) in the structure of the posterolateral arms of the aedeagus and the basal arms of the parameres, but the overall structure of parameres and apicolateral processes are dissimilar. The new species and *D. (D.) ampullariae* Macfie, 1934 (Malaysia, and China) look alike in parameres but the structure of the gonostylus, the apicolateral process and the aedeagus disagree. The combination of characters provided in the diagnosis validates *D. (D.) trigona* as a new member of this subgenus.

Distribution. The materials were collected from the Deltaic Proper of Gangetic of West Bengal at an altitude of 6–60 meters above sea level – new species from India.

Ecological notes. Adults of *Dasyhelea* (*D.*) *trigona* sp. nov. were trapped around a paddy field adjoining a freshwater river (Fig. 2C); the air temperature and relative humidity were 15–17 °C and 70–75% respectively.

Subgenus *Sebessia* Remm, 1979

Dasyhelea (*Sebessia*) *falxa* sp. nov.

<https://zoobank.org/D0ABBE88-3364-41BF-B418-85D03543EF81>

Type material. *Holotype* ♂, India, West Bengal, South 24 Parganas, Dayapur [22°07'25.0"N, 88°50'46.5"E], 23.V.2018, Coll. S. Brahma. **Paratype:** 1 ♂, same as before.

Diagnosis. The only species in the subgenus *Sebessia* with an elongated, oval shaped gonocoxite; gonostylus with less sclerotised middle region; basal arms of parameres sickle-shaped and funnel-shaped aedeagus.

Description. Male adult (n = 2) (Figs 6A–K, 8D). Total body length 2 mm.

Head. Brown in colour. Eyes not separated. Frontal sclerite (Fig. 6A) 46–53 μm long and 34.5–39 μm wide, rhomboid, evenly sclerotised moderately, without any apical projection. Flagellum (Fig. 6B) pale brown, 0.6 mm long; flagellomere XIII without any distinct apical projection; length ratio of flagellomeres (I–XIII): 24: 14: 13: 12: 12–13: 13: 13: 12–13: 12: 20: 20–21: 28: 35–36; AR 1.0; flagellomeres II–XIII with sensilla basiconica. Clypeus as in figure 6C, with 4 pairs of setae. Palpus (Fig. 6D) pale, straw coloured; length ratio of palp segments (I–V): 10: 13–13.5: 14–15: 10–10.5: 12; PR 2.3; palp segment III with 3 capitate sensilla at its basal one third region.

Thorax (Fig. 6E). Yellowish brown with pale streaks running laterads. Scutellum with 5 setae.

Wing (Fig. 6F). Macrotrichia sparse, RM cross vein broad, M_1 , Cu and CuA_1 more prominent. Wing margin with short, prominent macrotrichia and membrane with reduced macrotrichia at wing membrane. Wing 0.90 mm long, 0.29–0.30 mm wide; CR 0.47–0.53. Costa ending beyond cubital fork.

Legs (Fig. 6G). Pale brown in colour. TR_I 3.11–3.16, TR_{II} 2.87–3.57 and TR_{III} 2.77. Hind tibial comb (Fig. 6H) with 5 spines where outer one smallest.

Abdomen. Pale brown in colour.

Genitalia (Figs 6I, 8D). Tergite 9 broad apically, inverted dome shaped, 142.5–152 μm long and 145–161 μm wide. Apicolateral processes (Fig. 6J) indistinct, with one prominent seta, cercus with a single seta. Sternite 9 (Fig. 6I) with 34.5 μm long posteromedian process, 1.47× wider than length. Gonocoxite stout, with a mesoventral knob like structure, 71–73.5 μm long, 46–53 μm wide at middle, having 6–7 setae on dorsal side. Gonostylus stout, somewhat stumpy, 62–66.5 μm long, 18.5–23 μm wide basally and 7 μm wide apically, somewhat abruptly narrowed, bearing an apical, pale, oval depression; mid region less sclerotised; 2 inwardly directed setae at basal region; 1 dorsal seta at proximal one third length, centered between two lateral setae, ventrally 9–10 prominent setae, subapex bearing 3 setae. Parameres (Fig. 6I) with each basal arm 48.5–53 μm long, sickle shaped with 30 μm long projection. Aedeagus (Fig. 6K) funnel shaped with 43.5–46 μm long, 53–60 μm wide; basal arm indistinct, 7–9 μm long, enclosing 34.5–39 μm wide basal arch; posterolateral arm 27.5–30 μm long, apex recurved inwardly, both basal arm and posterolateral arm highly sclerotised; ventromedian projection bulging laterally and extended beyond posterolateral arm forming finger like apical projection.

Female adult. Unknown.

Pupa and larva. Unknown.

Etymology. The name, “*falxa*” derived from Latinised version of *sickle*, referring to the sickle-shaped basal arms of the parameres of male genitalia.

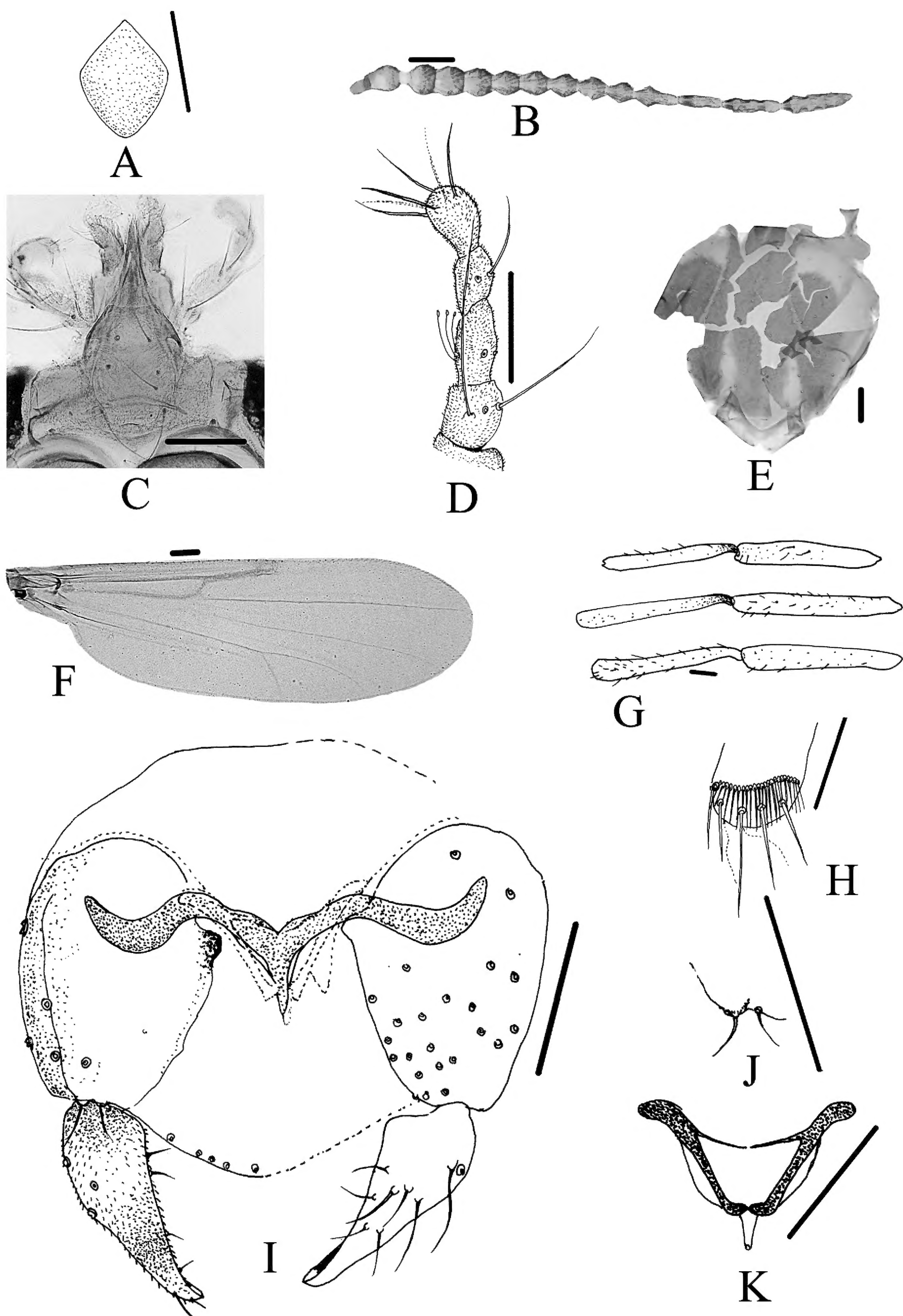


Figure 6. A–K Adult male of *Dasyhelea* (*Sebessia*) *falxa* sp. nov. **A** Frontal sclerite; **B** Flagellum; **C** Clypeus; **D** Palpus; **E** Thorax; **F** Wing; **G** Femora and tibiae (right to left) of fore, mid and hind legs; **H** Hind tibial comb; **I** Genitalia (left dorsal and right ventral view); **J** Apicolateral process; **K** Aedeagus. Scale bars: 0.05 mm.

Remarks. The new species shares similarities with *D. ona* Díaz, Spinelli & Ronderos, 2010 (Argentina) in the shape of the basal arms of the parameres but the shape of projection of parameres, gonostylus and aedeagus are markedly different. It also owes similarities with *D. (S.) holosericea* (Meigen, 1804) (Estonia, Finland, Poland, Lithuania, France, and Russia) in the structure of the gonostylus and basal arms of the parameres, but differs in the shape of gonocoxite and aedeagus. The shape of the parameres in the new species are quite similar with that of *D. caribbeana* Spinelli & Wirth, 1984 (Jamaica, Haiti, Panama, Mexico, and France), but the shapes of aedeagus and gonostylus shapes are markedly different. *Dasyhelea (S.) pauca* Yu and Zhan in Yu et al. 2005 (China) has somewhat similar shaped gonostylus and parameres, but the shape of the aedeagus is contrasting. The blend of characters stated in the diagnosis validates *D. (S.) falxa* as a new member of this subgenus.

Distribution. The specimens were collected from the Deltaic Proper of Gangetic West Bengal at an altitude of 8 meters above sea level – new species from India.

Ecological notes. Imagines of *Dasyhelea (S.) falxa* sp. nov. were captured in proximity of shrub vegetation, close to a brackish water river (Fig. 2D) when the air temperature was 33–35 °C and the relative humidity was 80–82%.

Dasyhelea (Sebessia) folia sp. nov.

<https://zoobank.org/729C8E33-BF5A-43F8-906E-A41FE77F6A31>

Type material. *Holotype* ♂, India, West Bengal, South 24 Parganas, Pakhralaya [22°08'13.0"N, 88°49'45.1"E], 25.V.2018, Coll. S. Brahma.

Diagnosis. The only species in the subgenus *Sebessia* bearing a distinct oval shaped gonocoxite; one long seta near base of gonostylus; broad and leaf like basal arms of parameres; apicolateral process with one long seta at subapical notch.

Description. **Male adult** (n = 1) (Figs 7A–J, 8E). Total body length 2.1 mm.

Head. Light brown in colour. Eyes separated by about a diameter of an ommatidium. Frontal sclerite (Fig. 7A) 55 µm long, 30 µm wide, oval shaped. Flagellum (Fig. 7B) 0.6 mm long; flagellomere XIII without any prominent apical projection; length ratio of flagellomeres (I–XIII): 23: 13: 12: 12: 12: 13: 13: 13: 13: 30: 22: 20: 34; AR 1.07; flagellomeres X–XIII with sensilla basiconica. Clypeus as in figure 7C, with 3 pairs of setae. Palpus (Fig. 7D) pale brown; length ratio of palp segments (I–V): 10: 10: 16: 11: 12; PR 2.3; palp segment III with 1 capitate sensillum at its mid length.

Thorax. Yellowish in colour.

Wing (Fig. 7E). Wing margin with short, prominent macrotrichia, macrotrichia in wing surface sparse. WL 0.91 mm long, WW 0.33 mm; CR 0.5. FCu proximal to costal extremity.

Legs (Fig. 7F). Pale brown in colour. Hind tibial comb (Fig. 7G) with 7 spines, third one longest. TR_I 3.0, TR_{II} 2.2 and TR_{III} 3.0.

Abdomen. Light brown in colour.

Genitalia (Fig. 7H, 8E). Tergite 9 broad apically, inverted dome shaped, 115 µm long and 133.5 µm wide. Apicolateral processes (Fig. 7I) 27.5 µm long, base 7 µm wide and apex 2.3 µm wide, a distinct notch at about mid length from base bearing one long seta; cercus bare. Sternite 9 (Fig. 7H) 1.93× wider than length with bifurcated posteromedian margin. Gonocoxite oval shaped, 78 µm long, greatest width 48 µm, having 3–4 stout, long setae on dorsal side. Gonostylus stumpy, 47 µm long, 16 µm wide basally and 4.5 µm wide apically; less sclerotisation up to mid length; somewhat abruptly narrowed at about three fourth length from base; a single, distinct, dorsal, long seta present near base followed by another one, ventrally 4 small setae at middle region and one long seta at basal region. Each basal arm of parameres (Fig. 7H) 34.5 µm long, broad and leaf like, joined moderately with 30 µm long posteromedian projection, extended beyond mid gonocoxite. Aedeagus (Fig. 7J) “H” shaped, 32 µm long, 43.5 µm wide; basal arm 18.5 µm long enclosing 26.5 µm wide basal arch; posterolateral arm 9 µm long, stout; ventromedian projection absent.

Female adult. Unknown.

Pupa and larva. Unknown.

Etymology. The name, “*folia*” derived from Latinised version of *leaf*, referring to somewhat leaf shaped basal arms of parameres of male genitalia.

Remarks. *Dasyhelea (Sebessia) folia* sp. nov. shows similarities with *D. dellapei* Díaz, Spinelli & Ronderos, 2010 (Argentina), *D. fueguina* Díaz, Spinelli & Ronderos, 2010 (Argentina) and *D. patagonica* Ingram & Macfie, 1931 (Argentina, and Chile) in the shape of the basal arms of parameres, but the overall structure of parameres, gonostylus and aedeagus are markedly apart. *Dasyhelea folia* has similarities with *D. (S.) holosericea* (Meigen, 1804) (Estonia, Finland, Poland, Lithuania, France, and Russia) in a similar shaped aedeagus and gonostylus, but the parameres, the apicolateral process and the gonocoxite are different. The new species is similar to *D. huertai* Grogan, Diaz, Spinelli & Ronderos, 2016 (France) and *D. turnbowi* Grogan, Diaz, Spinelli & Ronderos, 2016 (France) in respect to the parameres, but the venation pattern of the wing, the shape of tergite 9, the gonocoxite and gonostylus are opposing. The combination of characters stated in the diagnosis justifies *D. (Sebessia) folia* as a new member of this subgenus.

Distribution. The material was collected from the Deltaic Proper of Gangetic West Bengal, at an altitude of 8 meters above sea level – new species from India.

Ecological notes. Adults of *Dasyhelea (S.) folia* sp. nov. were captured in proximity of a flower garden adjoining a brackish water river (Fig. 2E), when the air temperature was 33–35 °C and the relative humidity was 80–82%.

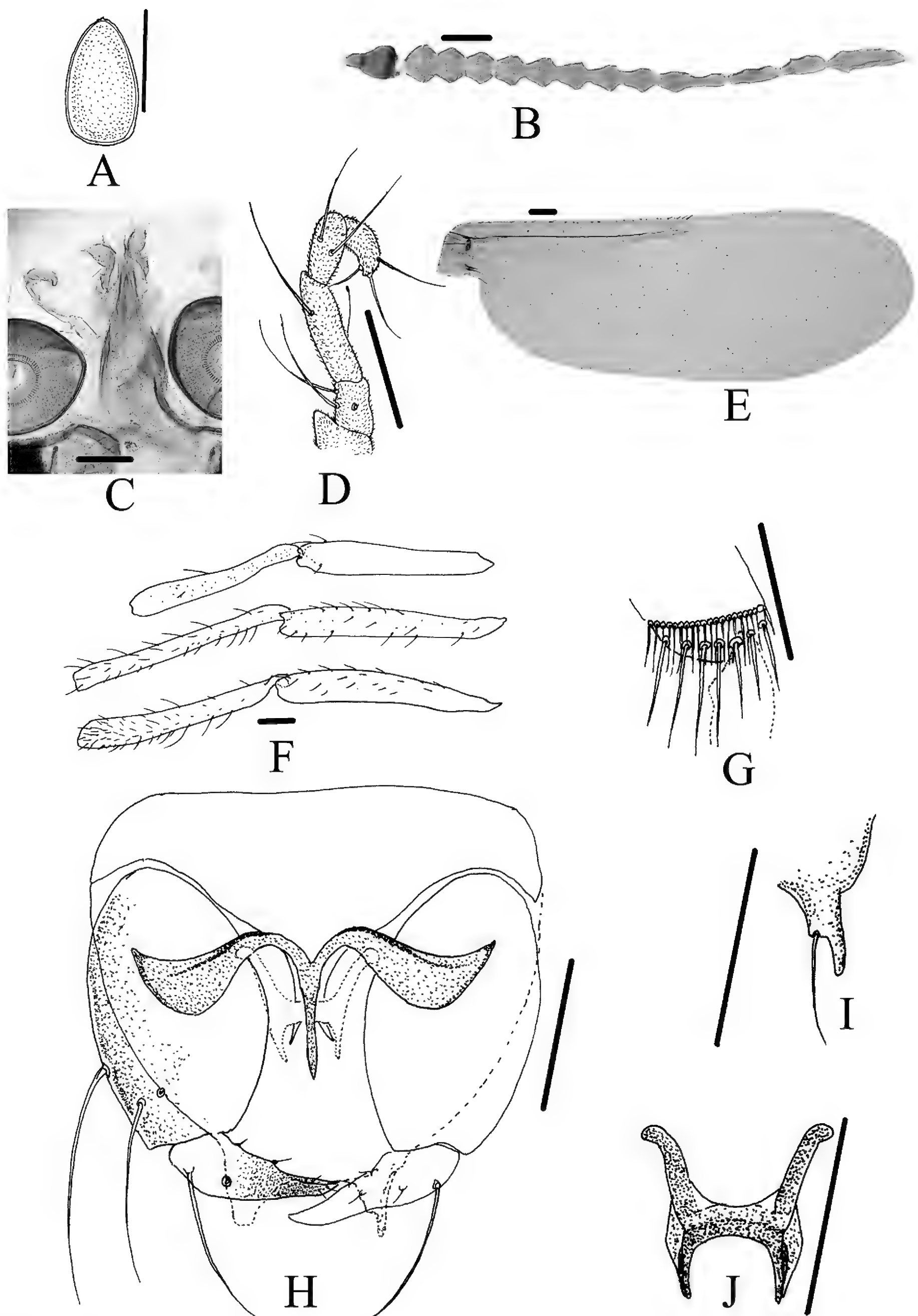


Figure 7. A–J Adult male of *Dasyhelea (Sebessia) folia* sp. nov. **A** Frontal sclerite; **B** Flagellum; **C** Clypeus; **D** Palpus; **E** Thorax; **F** Femora and tibiae (right to left) of fore, mid and hind legs; **G** Hind tibial comb; **H** Genitalia (left dorsal and right ventral view); **I** Apicolateral process; **J** Aedeagus. Scale bars: 0.05 mm.

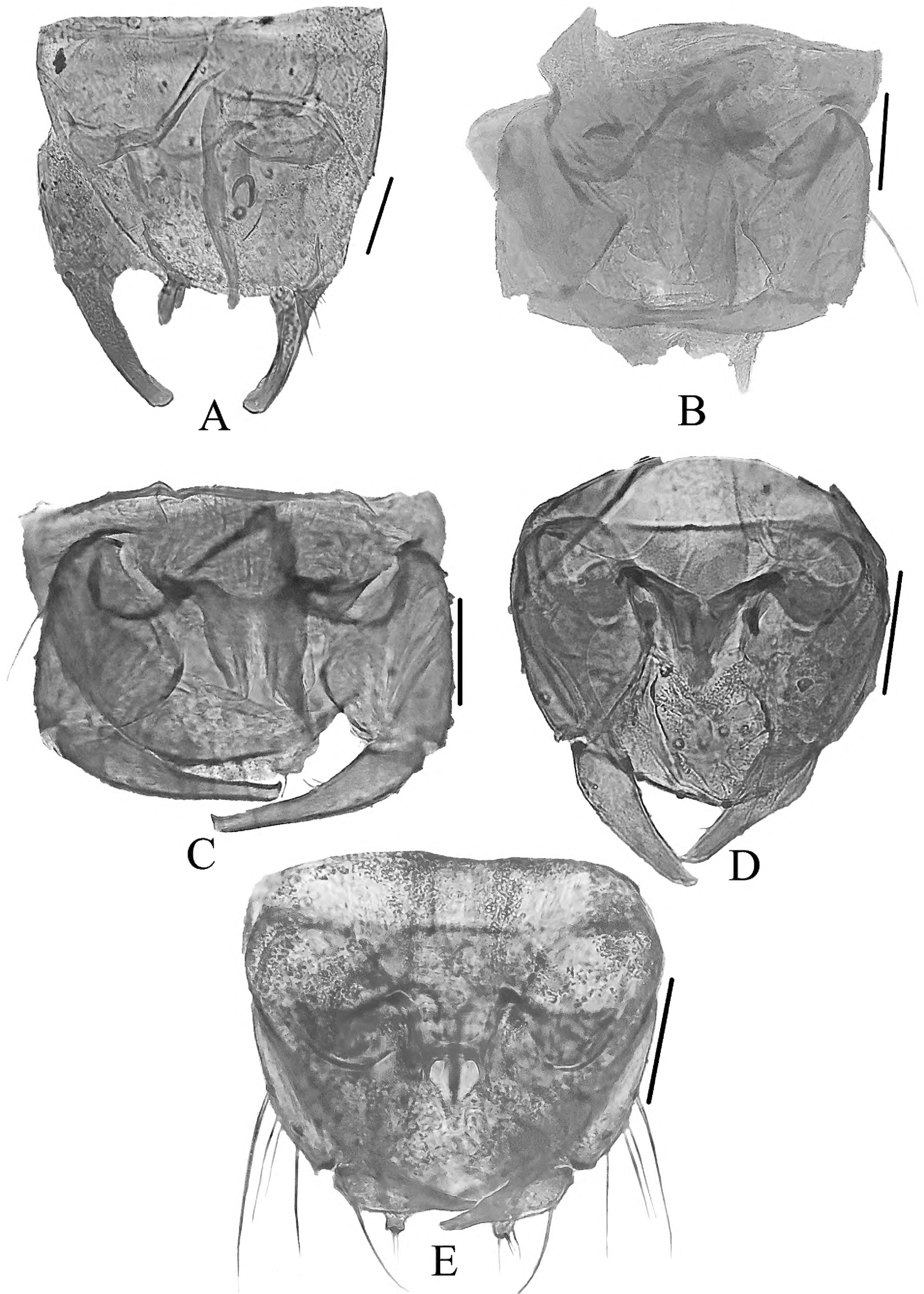


Figure 8. A–E Adult male genitalia structures. **A** *Dasyhelea (Dasyhelea) incisura* sp. nov.; **B** *Dasyhelea (Dasyhelea) quasifulcillata* sp. nov.; **C** *Dasyhelea (Dasyhelea) trigona* sp. nov.; **D** *Dasyhelea (Sebessia) falxa* sp. nov.; **E** *Dasyhelea (Sebessia) folia* sp. nov. Scale bars: 0.05 mm.

Key to the adult males of the subgenera *Dasyhelea* s. str. and *Sebessia* Remm of the genus *Dasyhelea* Kieffer from India

- 1 Frontal sclerite broader than long; apex of last flagellomere with apical extension; parameres asymmetrical 2 (subgenus *Dasyhelea* s. str.)
- Frontal sclerite narrow; apex of last flagellomere without apical extension; parameres symmetrical 6 (subgenus *Sebessia* Remm)
- 2 Palpal segment III with 4 capitate sensilla; subapex of gonostylus bearing a notch or constriction; posteromedian projection of parameres simple *D. (Dasyhelea) incisura* sp. nov.
- Palpal segment III with capitate sensilla either less than 4 or greater than 4; subapex of gonostylus simple, without notch or constriction; posteromedian projection of parameres either simple or bladelike 3



**posteromedian projection
of parameres**

***D. incisura* sp. nov.**

- 3 Posteromedian projection of parameres much broad and blade like, abruptly tapered *D. (Dasyhelea) quasifulcillata* sp. nov.
- Posteromedian projection of parameres simple, not bladelike, gradually tapered 4



**blade like
posteromedian projection
of parameres**

***D. quasifulcillata* sp. nov.**

- 4 Hind tibial comb with 8 spines; gonostylus prominently arched at middle; posterolateral arm of aedeagus bearing chitinous extensions *D. (Dasyhelea) multiforamina* Brahma, Chatterjee & Hazra, 2020
- Hind tibial comb with 6–7 spines; gonostylus not prominently arched at middle; posterolateral arm of aedeagus not bearing chitinous extensions 5
- 5 Palpal segment III with 6 capitate sensilla and capitate sensilla on segment IV lacking; hind tibial comb with 7 spines; gonostylus with simple tip, little curved; basal arm of aedeagus broad, triangular *D. (Dasyhelea) trigona* sp. nov.
- Palpal segments III and IV with 1 capitate sensillum on each; hind tibial comb with 6 spines; gonostylus with knobbed tip; basal arm of aedeagus tubular, arched *D. (Dasyhelea) pallidiventris* (Goetghebuer, 1931)



gonostylus with simple tip

***D. trigona* sp. nov.**



gonostylus with knobbed tip

***D. pallidiventris* Goetghebuer**

- 6 Posterior margin of sternite 9 rectangular; posterior extension of parameres reduced; aedeagus with triangular posterolateral arms *D. (Sebessia) fallax* Bose, Das Gupta & Chaudhuri, 2002
- Posterior margin of sternite 9 bifurcated or convex; posterior extension of parameres absent or well developed; posterolateral arms of aedeagus stout, elongated or curved at apex 7
- 7 Posterior margin of sternite 9 bifurcated 8
- Posterior margin of sternite 9 convex 9

- 8 Basal arms of parameres narrow and sickle shaped; aedeagus funnel shaped..... *D. (Sebessia) falxa* sp. nov.
 – Basal arms of parameres broad and somewhat leaflike; aedeagus stout, each half chair shaped*D. (Sebessia) folia* sp. nov.

sickle shaped basal arms of parameres



***D. falxa* sp. nov.**

leaf like basal arms of parameres



***D. folia* sp. nov.**

- 9 Frontal sclerite somewhat rhomboid in shape; basal region of posteromedian projection of parameres bulbous
 *D. (Sebessia) bulbosa* Brahma, Chatterjee & Hazra, 2020
 – Frontal sclerite somewhat oval in shape; basal region of posteromedian projection of parameres simple.....
 *D. (Sebessia) scalpra* Brahma & Hazra, 2018

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